## GROUND-WATER STATION DESCRIPTION WEST OBSERVATION WELL- 343022096565701 CHICKASAW NATIONAL RECREATION AREA, OK

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Date: April 5, 2006
Date: July 26, 2007
Date: July 27, 2007

#### LOCATION

Latitude 34° 30' 22.32" Longitude 96° 56' 59.28" (NAD83¹); T1S R3E S1 BBB01; Murray County, OK; Hydrologic Unit 11130303.

#### ACCESS:

Chickasaw National Recreation Area (CHIC) is located on State Highway 177, just south of the town of Sulphur, Oklahoma. The park is approximately 90 miles south of Oklahoma City, Oklahoma and 120 miles north of Dallas, Texas. Driving south from Oklahoma City on US I- 35 take exit 55 to State Highway 7. Driving north from Dallas on US I-35 take exit 51 to State Highway 7. Drive through the towns of Davis (3 miles) and Sulphur (10 miles) to the intersection of Highway 7 and 177. Drive south on Highway 177. Park Headquarters is located at 1008 West Second Street in Sulphur, Oklahoma.

The West Observation Well is located approximately 2500 feet west of Antelope Springs and 1000 feet S-SE of Sulphur well field. Drive on the one-way park road approximately 650 feet north and 40 feet west past Little Niagra parking lot. Park on the roadside then turn right (east) and continue by foot 100 feet uphill into the woods to the West Observation Well.

View attached maps.

#### NOTIFICATION:

Notify a local park partner when visiting the station.

#### **ESTABLISHMENT**

Drilled on July 17- August 4, 1972 by Delay and Bectel Drilling. Ground-water level monitoring began December 28, 1973 (Refer to **History** section for station operator details). The National Park Service (NPS) uses the well to monitor groundwater levels and evaluate regional trends in spring (Antelope, Buffalo, and Hillside) flow.

#### **WELL CHARACTERISTICS**

The well was originally drilled to a depth of 436 feet below land surface and open to the aquifer. Casing is believed to extend about 23 feet below land surface. Land surface datum was recorded as 1078.86 feet Geoid Model 2003 (GEOID03; from 2006 level survey)<sup>2</sup>.

#### **HYDROLOGIC CONDITIONS**

The West Observation Well in CHIC monitors water levels of the Arbuckle-Simpson aquifer. The aquifer is composed of the Arbuckle group, characterized by hard, dense limestone and dolomite, and the Simpson group, consisting of limestone, shale and fine to medium-grained sandstone. In the vicinity of the park, the Simpson and Arbuckle groups are overlain by a tightly cemented limestone conglomerate known as the Vanoss formation. The Vanoss formation acts as a confining unit controling discharge of the park's springs and Sulphur's artesian wells (NPS, 2003b).

Water from the Arbuckle-Simpson aquifer is likely forced upward through fractures in the confining layer, feeding five spring groups in the park. Antelope Spring and Buffalo Spring are two fresh water springs near the eastern boundary of the Travertine District. Hillside, Pavilion and Black Sulphur springs are the only three remaining spring groups

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<sup>&</sup>lt;sup>1</sup> North American Datum of 1983 (NAD83) is an earth-centered datum based on the Geodetic Reference System of 1980. The size and shape of the earth was determined through measurements made by satellites and other sophisticated electronic equipment; the measurements accurately represent the earth to within two meters.

<sup>&</sup>lt;sup>2</sup> Geoid Model 2003 (GEOID03) is a refined model of the geoid in the conterminous United States (CONUS).

characterized by higher mineral concentrations. These three springs and the famous flowing Vendome Well are located in the center of the Travertine District, west of the fresh water springs (Gould and Schoff, 1999; Hanson and Cates, 1999).

CHIC is located at the intersection of the eastern woodland and mixed-grass prairie ecological communities. Vegetation includes sycamore, pecan, hickory, and eastern red cedar of the eastern woodland community and grasses and prickly pear of the western prairie community. The predominant land use east of the park is grazing. The climate includes hot and humid summers with mild winters. The park receives about 38 inches of rainfall a year, with 22 inches falling as rain during the summer wet season (Oklahoma State University, 2003; NPS, 2003a).

#### GAGE

Water levels are measured by an In-Situ<sup>®</sup> Mini Troll 0-15 PSIG pressure transducer (serial number 012223) which includes an onboard "logger" and is powered by two alkaline cells (**Picture 1 and 2**). The Mini Troll is suspended by a string wire gage and attached to a rebar in the shelter's concrete base by a carabineer. A metal ring called a well dock is inset into the well casing. The well dock is no longer used for securing the probe but remains present at the station. The well casing has a 7.5 inch outer diameter and is housed in a corrugated cylinder "hut". The Measuring Point (MP), for taping down to ground-water level, is located on the top of the well casing and is marked with an arrow and labeled "MP Here" (Picture 3 and 4).

#### **HISTORY**

CHIC was originally established as Platt National Park in 1906. The name was changed to Chickasaw National Recreation Area in 1976 when an area of land, including the Lake of the Arbuckles, was added to the park.

July 17 – August 4, 1972 Well drilled. Water level recorded at 27.0 feet below land surface.

December 28, 1973

Stevens F type recorder installed by USGS. National Park Service monitored well from December 28, 1973 to January 28, 1986. Water levels have been entered into Ground Water Site Inventory (GWSI) at 5-day intervals when the record was considered reliable. Otherwise, only periodic water-level measurements made by the NPS were entered. Original copies of records for October 1, 1978 to January 28, 1986 are located in the permanent files of the NPS Water Resources Branch (WRB).

January 28, 1987

Stevens F recorder replaced with a Floppy Disk (FD) digital recorder (W8354) by USGS. (land surface datum = 0.00 ft, and depth to water = 28.33 ft). Daily values from digital record were stored on Automatic Data Processing (ADP) files on a continuing basis. The USGS collected data from January 28, 1987 to November 6, 2002. Record is sporadic and irregular with a gap of seven years between 1995 and 2002. Data for August 14, 1972 to November 6, 2002 are reported on the USGS's website <a href="http://nwis.waterdata.usgs.gov/">http://nwis.waterdata.usgs.gov/</a>.

The periods of record documented above come from a superseded USGS station description and the USGS's National Water Inventory System (NWIS). There is no water level data for times between these recorded periods.

June 17, 2003

In-situ Mini-troll installed by NPS for monitoring of ground-water levels. Darryl Carter began recording instantaneous ground-water level measurements.

October 19 and 20, 2005 Precision GPS<sup>3</sup> survey conducted and established RM1 elevation (1078.743 ft) base<sup>4</sup>.

May 22, 2007

Datum elevation changed to 1078.86 feet in ADAPS. The latitude and longitude in ADAPS was confirmed by similar coordinates determined for a temporary control. Data Descriptor (DD) 2 was removed from ADAPS.

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<sup>&</sup>lt;sup>3</sup> Global Positioning Systems (GPS) is a system of satellites, computers, and receivers that is able to determine the latitude and longitude of a receiver on Earth by calculating the time difference for signals from different satellites to reach the receiver.

<sup>&</sup>lt;sup>4</sup> The base is the reference mark on which all reference mark elevations are based. It is considered the most stable.

#### REFERENCE AND BENCHMARKS

One MP and four reference marks  $(RMs)^5$  have been established for this station. The MP is scratched into the top of the well casing (TOC) and labeled by an arrow and "MP here" on the concrete pad (**Picture 3**). TOC extends above the concrete pad less than a tenth of a foot, therefore, MP is considered equal to TOC and land surface. **Figure 1** depicts the West Observation Well, the instrument shelf and corrugated housing. A short rod ( $\approx 3$  feet) is needed to survey elevations within the corrugated housing. **Figures 2 and 3** depict the RM's locations.

A precision GPS survey conducted on October 19, 2005, established RM1 elevation (1078.743 ft) as base using the accuracy limit of 0.066 meter (refer to "Precision Global Positioning System Survey Summary" located in Section 4 of WY 2006 Folder). The March 31, 2004, and October 20, 2005, survey elevations were recalculated using RM1 as base and are located in Section 4 of WY 2006 Folder (chicw\_.1A, CHICW\_.1B, chicw-recal\_.1A SURVEY(1), chicw-recal\_.1B SURVEY (2)). Recalculating the 2004 and 2005 survey elevations reduced rounding and conversion differences, which aided in datum correction determination.

The rounding and conversion method is inconsequential, despite determining error propagation, because ground-water levels fluctuate more then the tenths of foot accuracy obtained. A stable datum has more impact on data quality then absolute elevation accuracy to the tenth of a foot. Survey elevation calculations are located in the WY 2006 Folder, Section 4: Survey Analysis.

Historic surveys (discussed in previous water year documents) conducted by the USGS on June 17, 1987, and November 21, 2002, have differences of -0.22 foot and -0.08 foot respectively from the October 19, 2005, survey. The survey differences are the National Geodetic Vertical Datum 1929 (NGVD29)<sup>6</sup> and Geoid Model 1999 (Geoid99)<sup>7</sup> vertical datum differences from Geoid03 (October 19, 2005 survey datum). USGS survey elevations are not documented in Table 1 because they are not used to determine datum corrections.

Table 1: Elevations in feet of MP and RMs.

	Measuring Point - Top of					
Date	Casing	RM1	RM2	RM3	RM4	Remarks (Elevations in feet)
3/31/2004 Survey (1)	1078.86	1078.74	1081.02	1080.31	1077.91	Calculations based on 10/19/2005 RM1 survey elevation. Calculations located in Water Year (WY) 2006 Folder, Section 4: Survey Analysis.
3/31/2004 Survey (2)	1078.86	1078.74	1081.02	1080.31	1077.91	Calculations based on 10/19/2005 RM1 survey elevation. Calculations located in Water Year (WY) 2006 Folder, Section 4: Survey Analysis.
10/19/2005 Survey A	1078.86	1078.74	1081.02	1080.32	1077.58	Engineer survey based on a temporary marker precision GPSed elevation obtained 10/20/2005. RM1 elevation of 1078.742 was calculated with averaging, rounding, and survey error. The measured elevation without the averaging and survey error was 1078.743 ft (refer to chicw1A). The RM4 elevation is considered incorrect.
10/20/2005 Survey B	NS	1078.74	NS	1080.31	1077.91	Engineer survey based on 10/19/2005 RM1 survey elevation.

NS = Not Surveyed

#### **REGULATION AND DIVERSION**

The West Observation Well may be affected by nearby municipal wells.

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<sup>&</sup>lt;sup>5</sup> Reference Marks (RMs) are a permanent marker installed in the ground or on a structure in the vicinity of the gage. Its elevation above the gage datum is known. Can also be referred to as a Reference Point (RP).

<sup>&</sup>lt;sup>6</sup> National Geodetic Vertical Datum 1929 (a fixed reference adopted as a standard deodetic datum for elevations determined by leveling. It was formerly called "Sea Level Datum of 1929." Although the datum was derived from the mean sea level at 26 tide station, it does not necessarily represent local mean sea level at any particular place.)

<sup>&</sup>lt;sup>7</sup> Geoid Model 1999 is a model with submeter level of accuracy developed by the National Geodetic Survey. It is used as a zero surface to establish consistent and accurate elevations worldwide.

#### **ACCURACY**

Record accuracy was considered excellent when station equipment was working. The In-Situ® Mini Troll accuracy was  $\pm 0.1\%$  of its full scale output (15 psi) and  $\pm 0.05\%$  when at 15° Celcius (In-Situ®, 1999). Accuracy may be downgraded due to data corrections applied for equipment settling, unit conversion, seismic events, pump tests, measuring tape accuracy ect. Refer to the 1987 Station Description for accuracy of past recorder accuracy.

#### COOPERATION

USGS monitored the well between January 1986 and November 2002 under the state-wide data collection program.

In June 2003, park staff began observing and collecting ground-water level data. The WRB reviews monitoring efforts and processes data.

#### **LOCAL PARK PARTNERS**

WELL OBSERVER: Darryl Carter (Technician) Cell Phone: (580) 618-1032

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CONTACTS: Steve Burrough

Natural Resource Specialist

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Sue Braumiller Regional Hydrologist

Office Phone: (580) 622-3161 ext. 1-611

ADDRESS: 1008 West Second Street Sulphur, OK 73086

#### **REFERENCES**

Gould, C.N., and S.L. Schoff. 1999, Geological report of water conditions of Platt National Park, Oklahoma. Abstract. USGS Report OFR 39-14. <a href="http://wwwok.cr.usgs.gov/abstracts/ofr39-14.html">http://wwwok.cr.usgs.gov/abstracts/ofr39-14.html</a>.

Hanson, R.L. and S. W. Cates. 1999, Hydrogeology of the Chickasaw National Recreation Area, Murray County, Oklahoma. Abstract. USGS Report WRIR 94-4102. <a href="http://wwwok.cr.usgs.gov/abstracts/wrir94-4102.html">http://wwwok.cr.usgs.gov/abstracts/wrir94-4102.html</a>>.

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National Park Service. 2003a, Chickasaw National Recreation Area: Plan your visit. < http://www.nps.gov/chic/pphtml/planyourvisit.html>.

National Park Service. 2003b, Geology Fieldnotes: Chickasaw National Recreation Area. <a href="http://www2.nature.nps.gov/grd/parks/chic/index.htm">http://www2.nature.nps.gov/grd/parks/chic/index.htm</a>.

"Troll Model SP400Operators Manual" April 1999. In-Situ Inc. 16 March 2006 < http://www.in-situ.com/insitu/Downloads/pdf/OpsMan/TROLL4000.pdf >

#### GAGING SITE EQUIPMENT PICTURES

343022096565701 West Observation Well CHIC

Photos by Jennifer Back Taken November 7, 2003



Picture 1: In-situ Mini Troll 0-15 PSIG transducer-datalogger



**Picture 3:** Suspension set-up at West Observation Well. Note Measuring Point (MP) .and carabineer



Picture 2: Inside In-situ Mini Troll transducer- datalogger

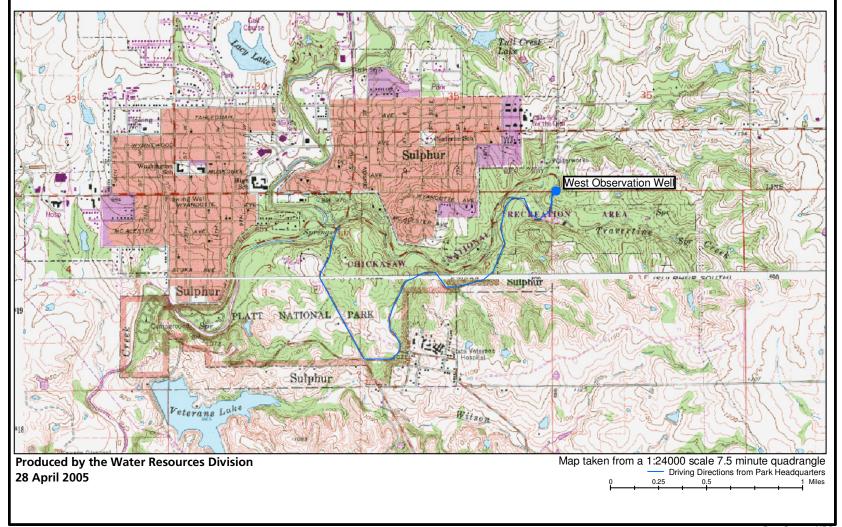


Picture 4: Site and data set-up.

### NATIONAL PARK

### Driving Directions to West Observation Well 343022096565701

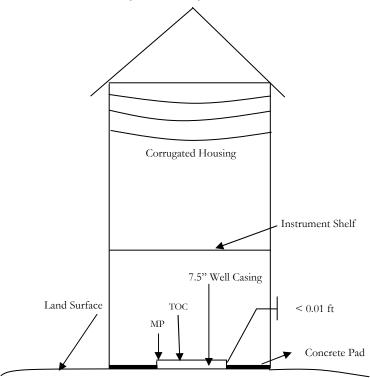




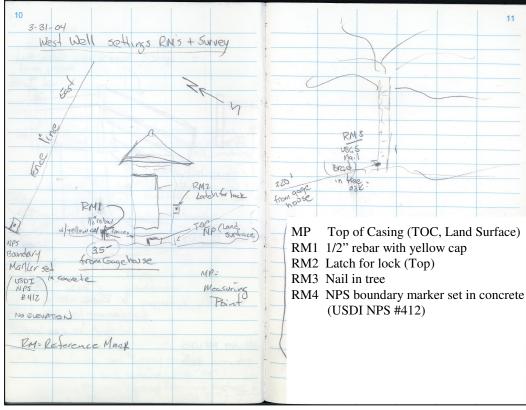
FILE: //inpfoclms1/wrb/chris/CHIC/GIS map/Map.mxd

Data Source: NPS

Figure 1: Sketch of West Observation Well (Not to Scale)







# REFERENCE MARK PICTURES Pictures taken October 19, 2005 Photographs taken by NPS – WRB Jennifer Back FIGURE 3



